AUDL 4007

Auditory perception

(with a healthy dose of psychoacoustics …)

What is psychoacoustics?

- Psychophysics
  - Mapping the relationship between the physical/objective and perceptual/subjective world.
- Psychoacoustics — psychophysics of sounds.
- How does the loudness of a sound relates to its intensity?
  - loudness depends not only on intensity but also on frequency content
- Changing the fundamental frequency of a periodic sound from 100 to 200 Hz will not lead to the same perceived musical interval as a change from 800 Hz to 900 Hz.

100-200 Hz

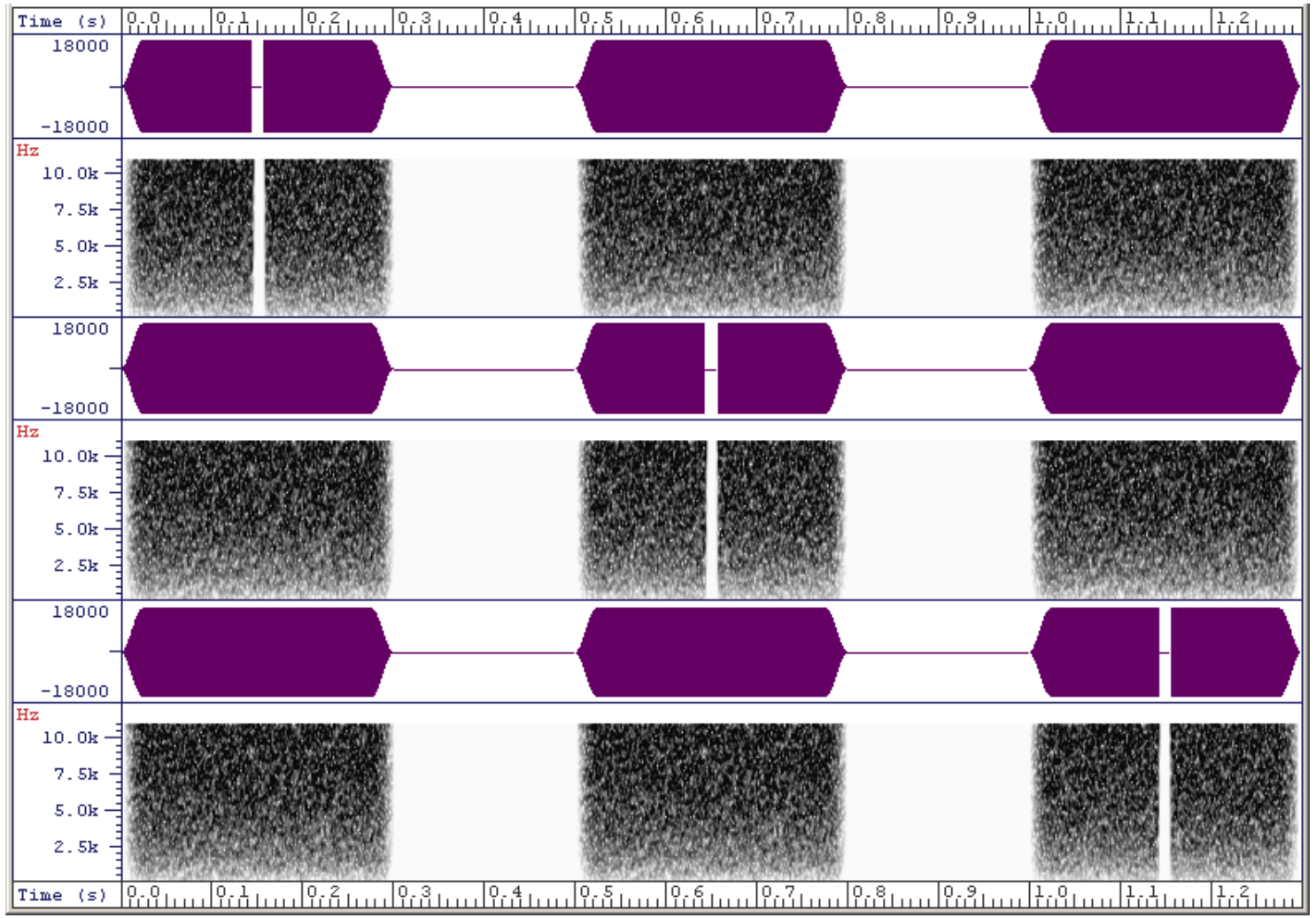
800-900 Hz

800-1600Hz

What is psychoacoustics?

- Terminology: Objective vs. subjective
  - intensity (W/m^2, Pa, dB SPL) vs. loudness
  - periodic/aperiodic vs. buzziness/noisiness
  - fundamental frequency (Hz) vs. pitch
  - spectral envelope/shape vs. timbre/quality/colour
- Much of psychoacoustics concerns abilities to …
  - detect
    - many HI people and CI users need higher levels to detect sounds
  - discriminate
    - many HI people and CI users need greater differences between stimuli to hear a difference between them
  - but limits on detectability and discriminability can also provide crucial data for developing models of auditory perception even in normal listeners

Gap detection (Tone in Noise?)
A fairly typical psychoacoustic task



time →

Gap detection

- Pick the sound with the gap – vary the gap duration to find threshold
  - when a listener is ‘doing well’, make it harder
  - when a listener is ‘doing poorly’, make it easier
  - What does this remind you of?
    - Another so-called adaptive procedure
- Thresholds for wide-band noise are around 3 ms

Course structure

- 10 sessions, a mixture of lectures, demonstrations, laboratory sessions and tutorials

- Topics to be covered
  - A review of peripheral auditory physiology
  - Frequency selectivity and masking
  - Envelope and Temporal Fine Structure
  - Pitch perception, simple and complex
  - Intensity perception
  - Temporal resolution
  - Binaural processing
  - A little bit about psychophysical methods
  - Auditory scene analysis
  - Effects of hearing impairment
  - Cochlear implants
  - Perceiving speech in noise

Readings

- Main text: Plack C. (2014) *The Sense of Hearing, 2nd edition*. Erlbaum.

- Supplementary Reading
  - Yost, W.A. (2007) *Fundamentals of Hearing: An Introduction*, 5th ed. Academic Press. A more elementary exposition. Particularly good on the anatomy & physiology.
  - J Schnupp, E Nelken & A King (2010) Auditory Neuroscience: Making Sense of Sound (MIT Press). A very new book with much more discussion of the neural substrates, and focus on a more limited range of topics.
  - Moore, B.C.J. (1997). An Introduction to the Psychology of Hearing, latest edition., Academic Press. A very complete guide to the literature, but at an advanced level.

- Other suggestions, links and papers on the web site
  - http://www.phon.ucl.ac.uk/courses/spsci/AUDL4007/index.html

Assessment

- 2-hour written paper (70%)
  You must pass the final exam to pass the course.

- 2 pieces of coursework, each worth 15% of the final mark (max 1000 words each)
  - Written essays presenting a published psychoacoustic study in a journalistic format, appropriate for lay readers.
  - You will also critique another student's paper, and rewrite from comments.

- Start thinking about the first study you will report on, reading carefully the information on the web site
  - Must be about auditory perception
  - Choose a paper you can explain to a lay audience (e.g., your grandfather!)
    - In other words, a topic that is interesting to people generally and not too technically complicated
  - *Not* in an area related to your project
  - *Not* a review paper

How to succeed in this course

- Attend the lectures
- Do the reading
- Check the web site
- Laboratory sessions should help to clarify the material presented
- Bring questions to the sessions
- Keep up with the work
- If you have problems, *ask for help!*

The End